

FIGURE 1

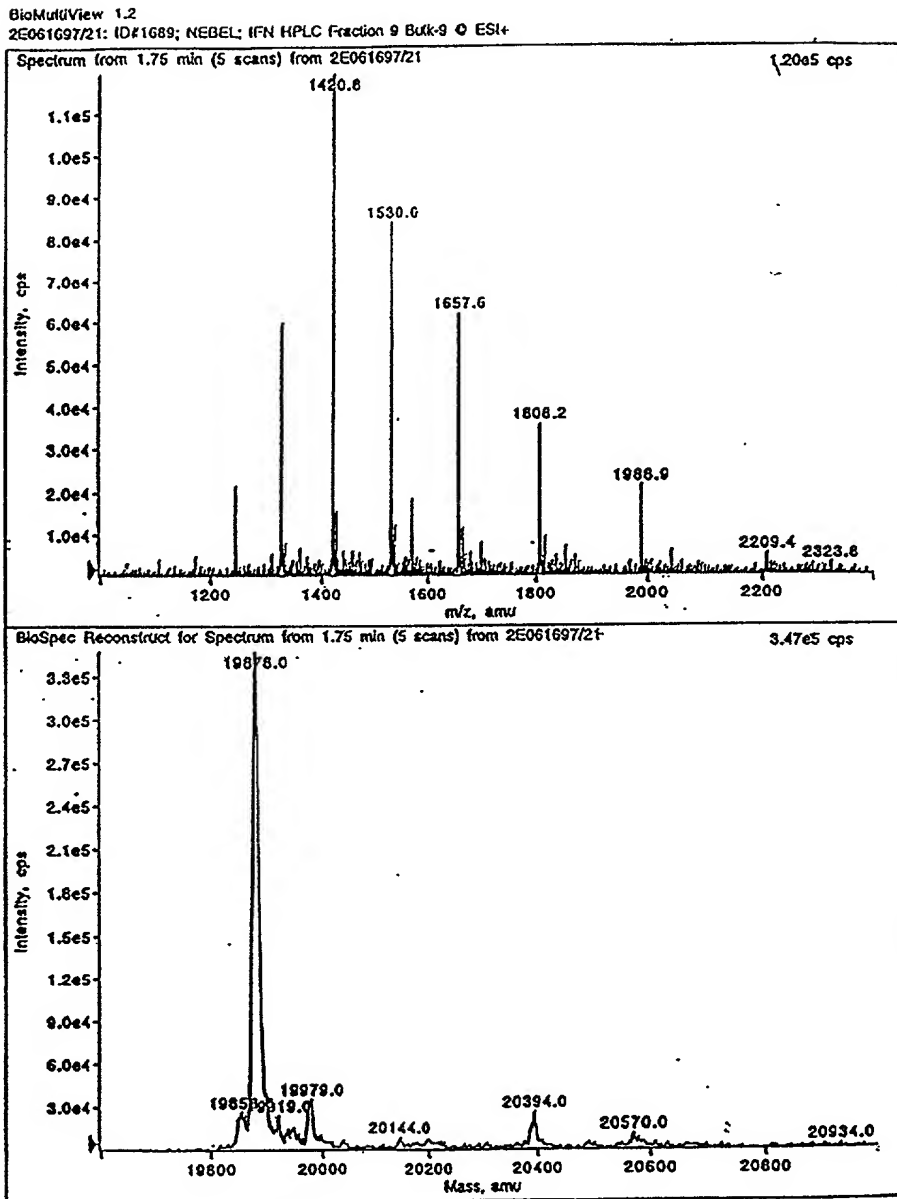


FIGURE 2

BioMultiView 1.2

2E0G1697/19, ID#1609; NEBEL; IFN HPLC Fraction 9 7D50c-10 @ ESI+

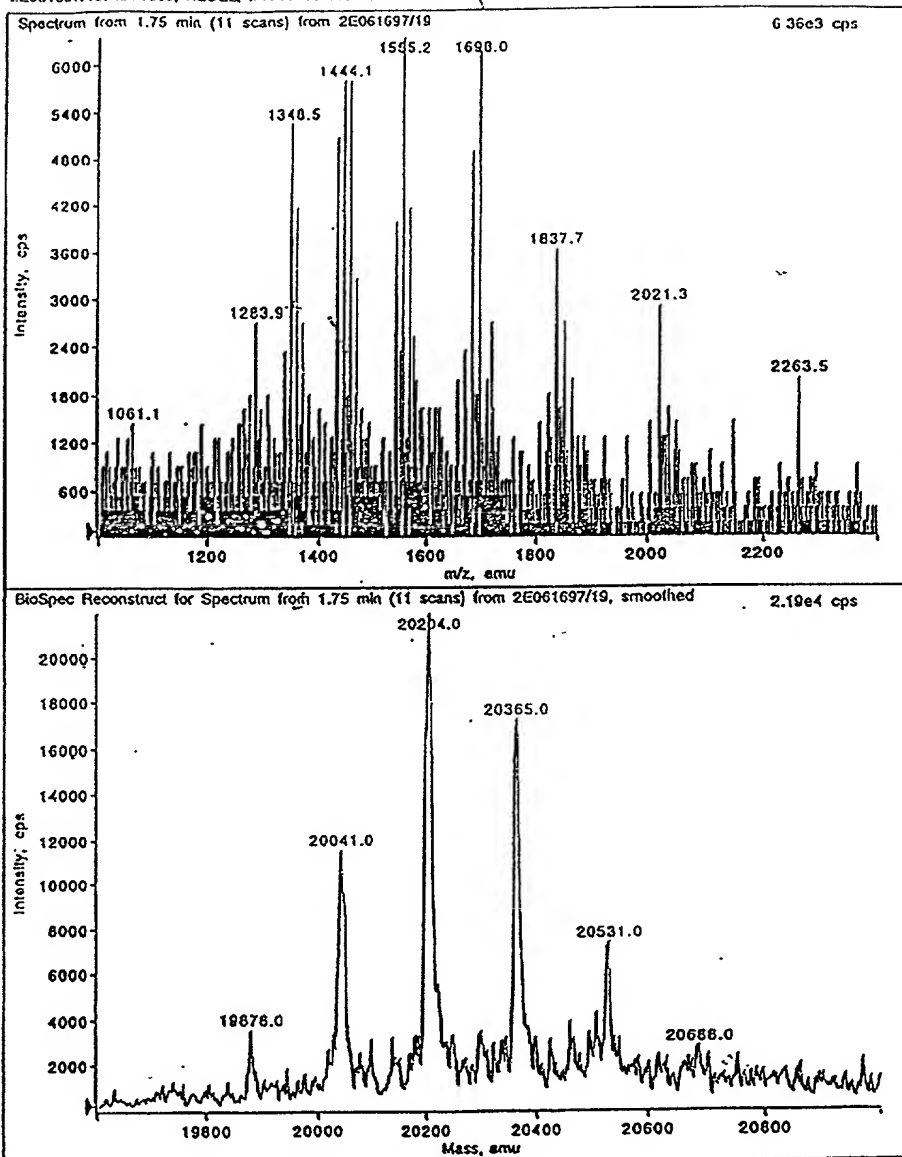


FIGURE 3

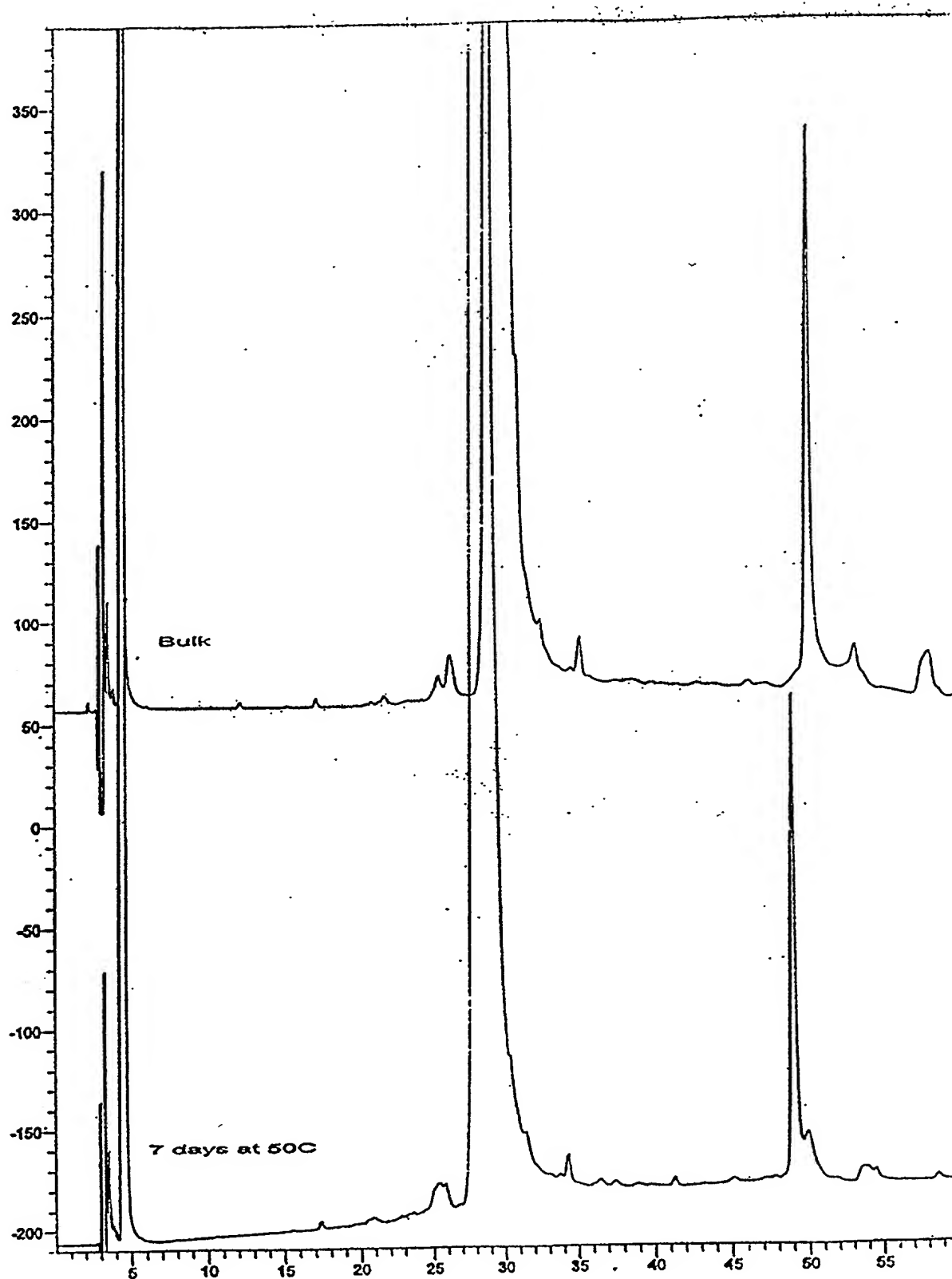


FIGURE 4

BioMultiView 1.2

2E061097/19; ID#1684; Nebel; 2a bulk 8 @ ESI+

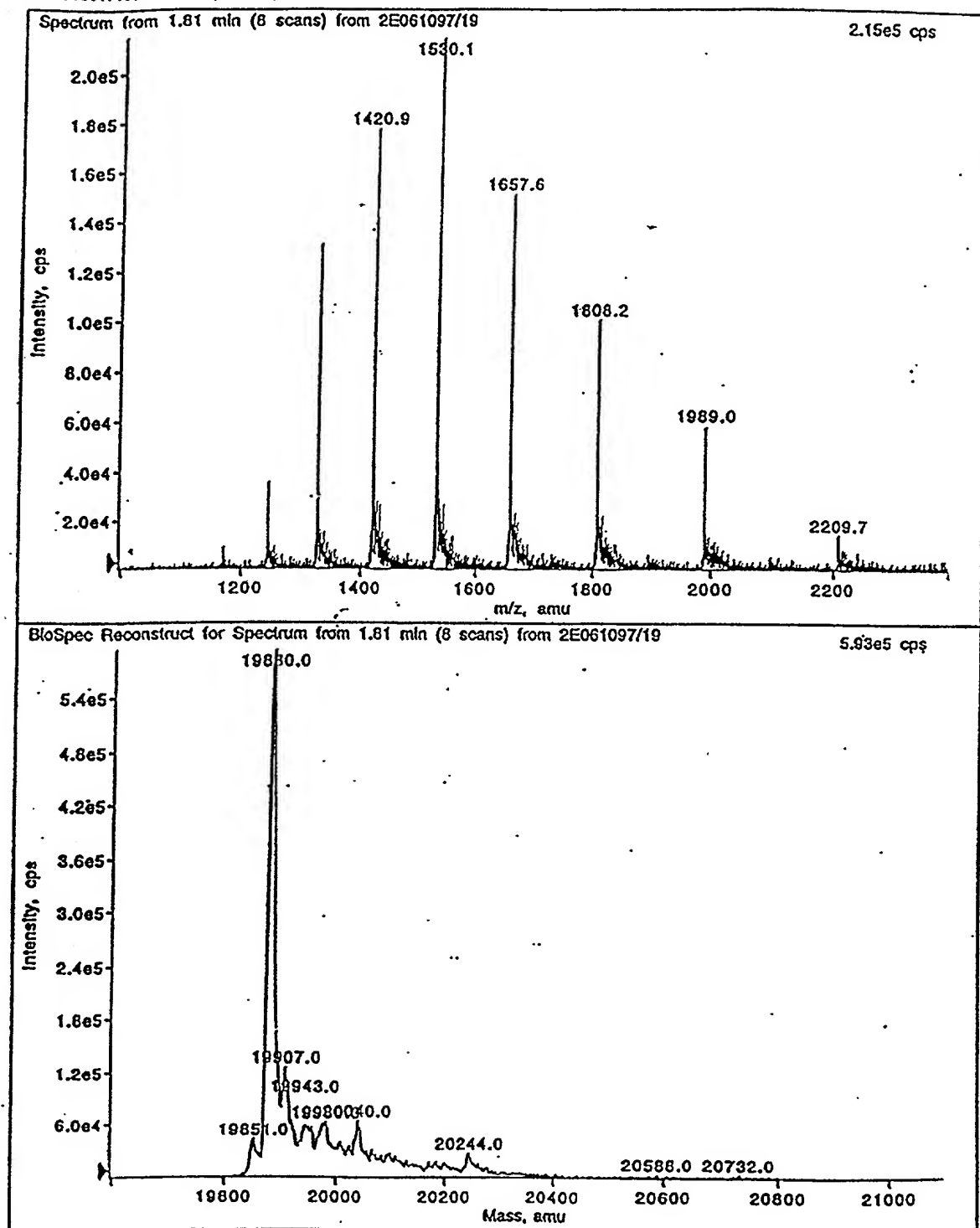


FIGURE 5

BioMultiView 1.2

2E061097/21: (D#1684; Nebal; 2e 7D50c 9 @ ESI+)

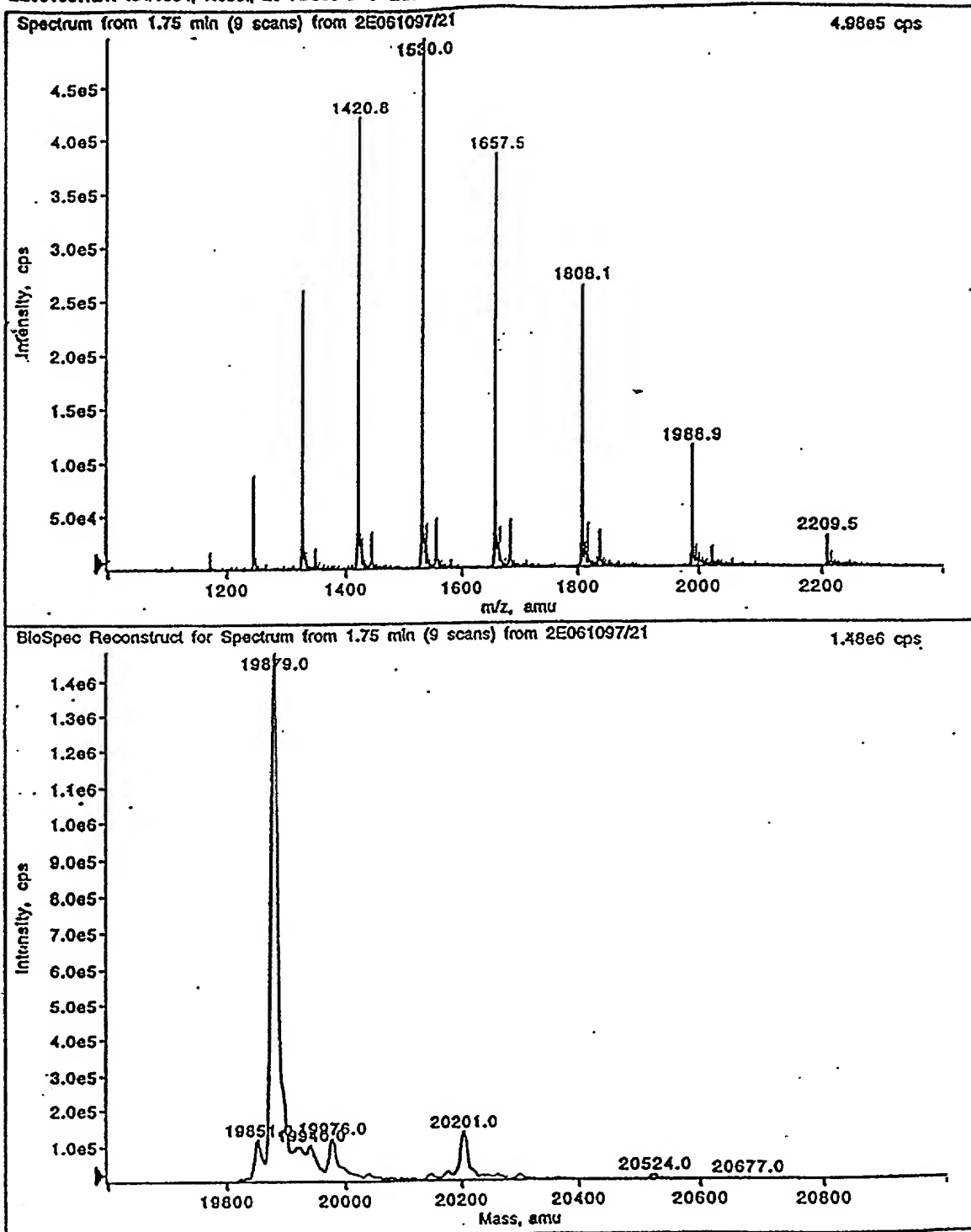


FIGURE 6

2E100297/01: ID#1746; Nebel; FB#1 IFN Fl. 929A001 @ ESI+

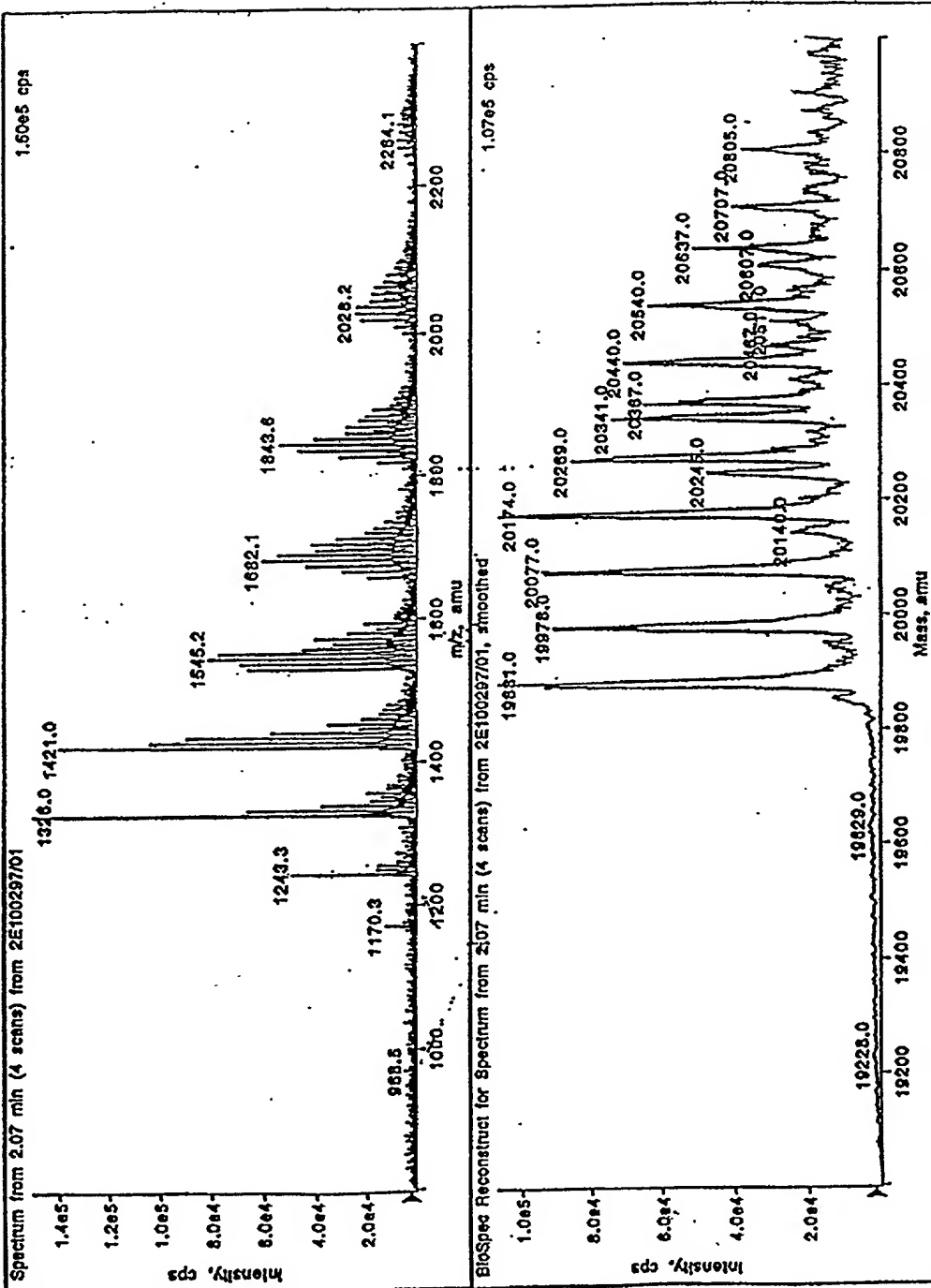


FIGURE 7

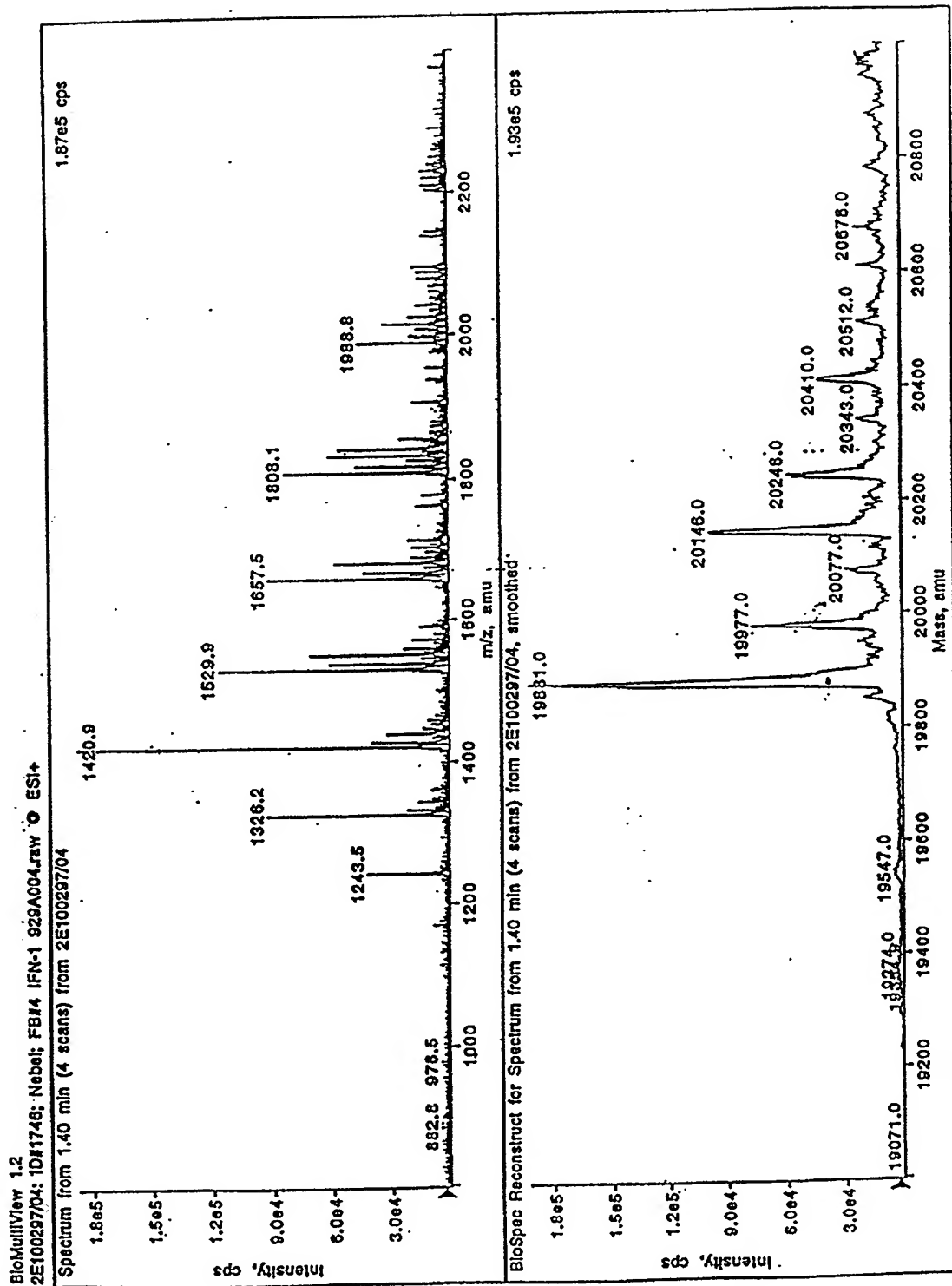


FIGURE 8



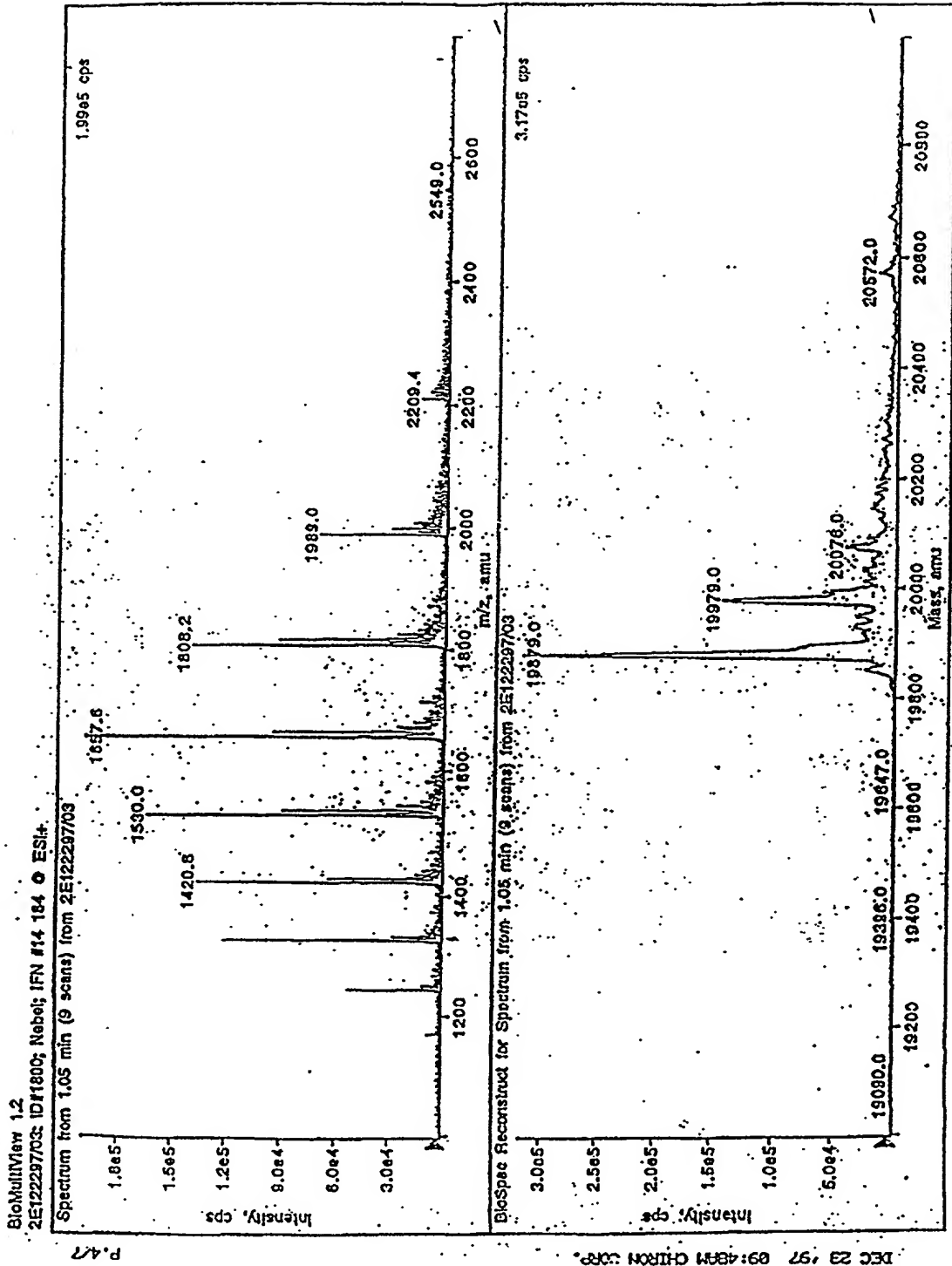


FIGURE 9

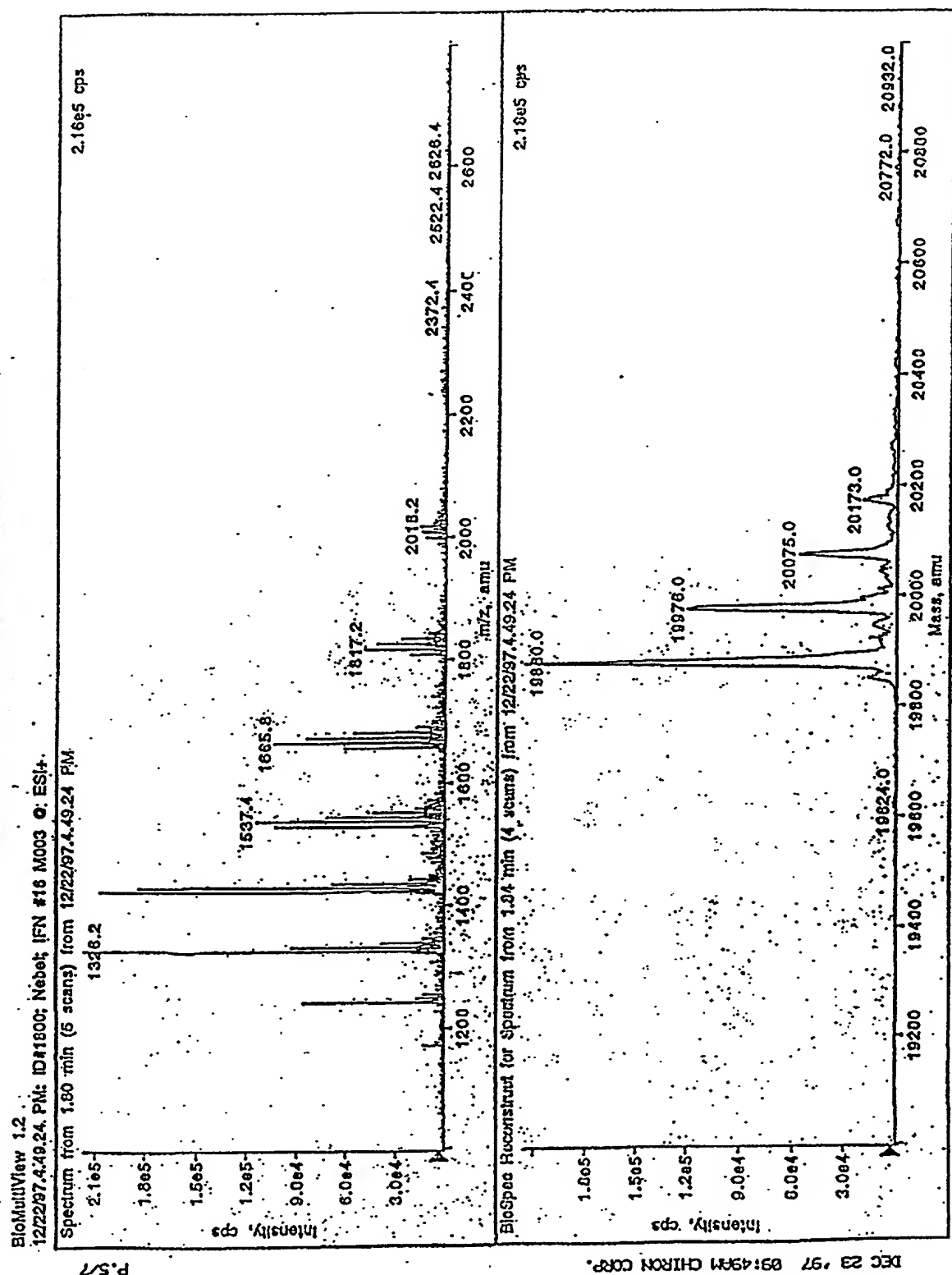


FIGURE 10

BiMolView, 1.2

2E12229717: ID#1800; Nebol; IFN #17 S O ESI+

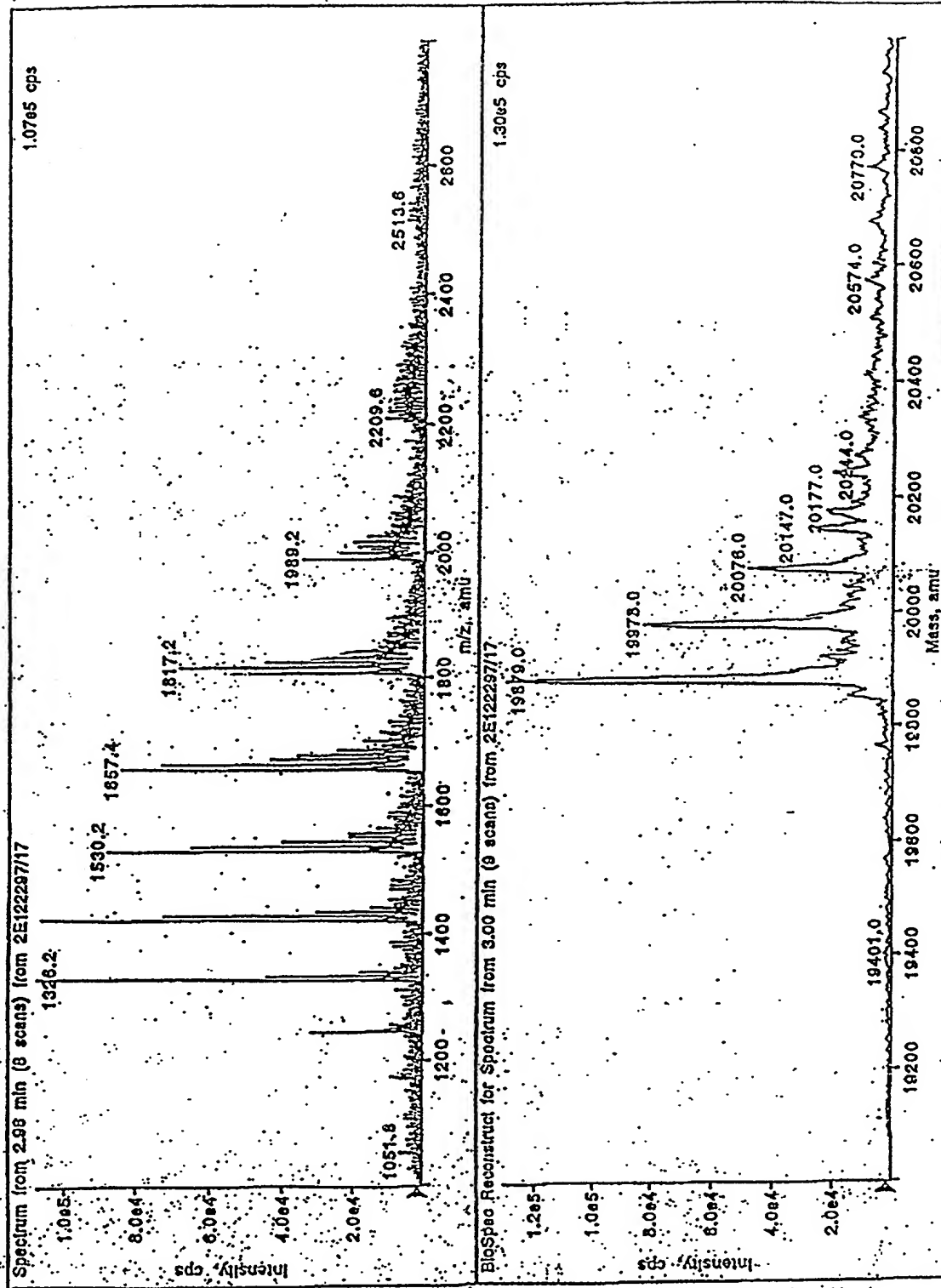


FIGURE 11

## STABILITY EVALUATION DATA

### Interferon- $\beta$ -1b: Dextrose Formulation

Product	Storage Temperature (upright, protected from light)	Months	Potency (Specific activity, IU/mg)	Glucosylated IFN- $\beta$ -1b concentration (mg/ml)	Total IFN $\beta$ -1b concentration (mg/ml)
IFN- $\beta$ 1b 0.25 mg/ml 1.25 % dextrose 1.25 % HSA  Lot: MBAPM023 7200-607	+ 8°C	0	$2.13 \times 10^7$	<0.02	0.22
	+ 8°C	1	$2.50 \times 10^7$	<0.02	0.23
	+ 8°C	2	$2.71 \times 10^7$	<0.02	0.23
	+ 50°C	2.2	$3.52 \times 10^7$	<0.02	0.23
	+ 50°C	2.5	$4.68 \times 10^7$	Too degraded	Too degraded
	+ 50°C	2.7	$4.60 \times 10^7$	Too degraded	Too degraded
	+ 50°C	3	$5.61 \times 10^7$	Too degraded	Too degraded
	+ 8°C	3	$2.41 \times 10^7$	<0.02	0.23
IFN- $\beta$ 1b 0.25 mg/ml 1.25 % dextrose 1.25 % HSA  Lot: MBAPM027 7200-600	+ 25°C	0	$2.12 \times 10^7$	<0.02	0.22
	+ 25°C	1	$2.05 \times 10^7$	<0.02	0.21
	+ 25°C	2	$3.24 \times 10^7$	<0.02	0.22
	+ 50°C	2.2	$3.88 \times 10^7$	<0.02	0.21
	+ 50°C	2.5	$4.64 \times 10^7$	Too degraded	Too degraded
	+ 50°C	2.7	$5.08 \times 10^7$	Too degraded	Too degraded
	+ 50°C	3	$5.91 \times 10^7$	Too degraded	Too degraded
	+ 25°C	3	$2.51 \times 10^7$	<0.02	0.23
IFN- $\beta$ 1b 0.25 mg/ml 1.25 % dextrose 1.25 % HSA  Lot: MBAPM027 7200-600	+ 37°C	0	$2.12 \times 10^7$	<0.02	0.22
	+ 37°C	1	$2.85 \times 10^7$	<0.02	0.18
	+ 37°C	2	$3.88 \times 10^7$	<0.02	0.23
	+ 50°C	2.2	$4.28 \times 10^7$	Too degraded	Too degraded
	+ 50°C	2.5	$4.88 \times 10^7$	Too degraded	Too degraded
	+ 50°C	2.7	$4.72 \times 10^7$	Too degraded	Too degraded
	+ 50°C	3	$5.44 \times 10^7$	Too degraded	Too degraded
	+ 37°C	3	$4.08 \times 10^7$	Too degraded	Too degraded

FIGURE 12

## STABILITY EVALUATION DATA

### Interferon- $\beta$ -1b: Highly Purified Mannitol Formulation

Product	Storage Temperature (upright, protected from light)	Months	Potency (Specific activity, IU/mg)	Glucosylated IFN- $\beta$ -1b concentration (mg/ml)	Total IFN $\beta$ -1b concentration (mg/ml)
IFN- $\beta$ 1b 0.25 mg/ml 1.25 % highly purified mannitol 1.25 % HSA	+ 8°C	0	$1.40 \times 10^7$	<0.02	0.22
	+ 8°C	1	$1.52 \times 10^7$	<0.02	0.21
	+ 8°C	2	$1.69 \times 10^7$	<0.02	0.22
	+ 50°C	2.2	$1.68 \times 10^7$	<0.02	0.22
	+ 50°C	2.5	$1.68 \times 10^7$	<0.02	0.21
	+ 50°C	2.7	$1.54 \times 10^7$	<0.02	0.21
	+ 50°C	3	$1.53 \times 10^7$	<0.02	0.22
	+ 8°C	3	$1.62 \times 10^7$	<0.02	0.23
IFN- $\beta$ 1b 0.25 mg/ml 1.25 % highly purified mannitol 1.25 % HSA	+ 25°C	0	$1.40 \times 10^7$	<0.02	0.22
	+ 25°C	1	$1.58 \times 10^7$	<0.02	0.21
	+ 25°C	2	$1.88 \times 10^7$	<0.02	0.22
	+ 50°C	2.2	$1.84 \times 10^7$	<0.02	0.22
	+ 50°C	2.5	$1.67 \times 10^7$	<0.02	0.20
	+ 50°C	2.7	$1.61 \times 10^7$	<0.02	0.21
	+ 50°C	3	$1.53 \times 10^7$	<0.02	0.22
	+ 25°C	3	$1.59 \times 10^7$	<0.02	0.23
IFN- $\beta$ 1b 0.25 mg/ml 1.25 % highly purified mannitol 1.25 % HSA	+ 37°C	0	$1.40 \times 10^7$	<0.02	0.22
	+ 37°C	1	$1.50 \times 10^7$	<0.02	0.21
	+ 37°C	2	$1.80 \times 10^7$	<0.02	0.21
	+ 50°C	2.2	$1.86 \times 10^7$	<0.02	0.21
	+ 50°C	2.5	$1.84 \times 10^7$	<0.02	0.20
	+ 50°C	2.7	$1.73 \times 10^7$	<0.02	0.20
	+ 50°C	3	$1.41 \times 10^7$	<0.02	0.20
	+ 37°C	3	$1.53 \times 10^7$	<0.02	0.22

FIGURE 13

STABILITY OF BETASERON / BETAFERON FINAL CONTAINER PRODUCT  
 RESULTS FOR LOT MEDPN005 (MANNITOL FORMULATION)

Storage Temp. (°C)	Months in Storage	Filling (rate)	Appearance			Realidual Moisture (% by weight)	pH Upon Reconstitution	Potency CPE/Bleed assay (IU/mg x 10 <sup>7</sup> )	Container Closure Integrity Dye Leak Test	Sterility
			Upon Reconstitution	Upon Reconst. Clarity	Upon Reconst. Color					
	0	white	clear, slightly yellow	--	--	0.3	7.4	2.3	--	Pass
4	2	--	--	--	--	0.4	--	--	--	--
4	3	white	clear, colorless	--	--	0.5	7.3	2.8	--	--
4	4	--	--	--	--	0.4	--	--	--	--
4	5	--	--	--	--	--	--	--	--	--
4	6	white	clear, colorless	--	--	0.4	7.3	3.4	--	--
4	9	white	clear, colorless	--	--	0.5	7.4	3.1	--	--
4	12	white	clear, colorless	--	--	0.5	7.5	3.2	--	--
4	18	white	clear, slightly yellow	II	colorless	0.6	7.4	3.3	--	--
4	24	white	clear, slightly yellow	<II	>BY <sub>4</sub>	0.6	7.5	3.2	Pass	Pass
30	2	--	--	--	--	0.7	--	--	--	--
30	3	white	clear, colorless	<II	<BY <sub>4</sub>	0.6	7.3	3.3	--	--
30	4	--	--	--	--	0.6	--	--	--	--
30	5	--	--	--	--	--	--	--	--	--
30	6	white	clear, slightly yellow	<II	BY <sub>4</sub>	0.7	7.4	3.1	--	--
30	9	white	clear, colorless	<III	<BY <sub>4</sub>	0.8	7.5	3.1	--	--
30	12	white	clear, colorless	--	--	0.8	7.5	3.6	--	--
30	18	white	clear, slightly yellow	<II	colorless	1.0	7.4	2.8	--	--
30	24	white	clear, slightly yellow	<III	>BY <sub>4</sub>	1.1	7.4	3.3	Pass	Pass
European Specifications:			Clear, colorless to light yellow	NMT Ref III	Colorless to slightly yellow NMT BY <sub>4</sub>	NMT 3%	7.1-7.5	2.2 to 4.5 x 10 <sup>7</sup>	Pass	Pass

FIGURE 14(A)

STABILITY OF BETASERON / BETAFERON FINAL CONTAINER PRODUCT  
RESULTS FOR LOT MBDPN006 (MANNITOL FORMULATION)

Storage Temp. (°C)	Months in Storage	RP-HPLC Analysis	
		Interferon beta-1b (Peak B + Peak B1)	Peak B1 (glucosylated)
	0	--	--
4	2	--	--
4	3	--	--
4	4	--	--
4	5	--	--
4	6	0.24	<0.02
4	9	0.25***	<0.02***
4	12	0.23***	<0.02***
4	18	0.23	<0.02
4	24	0.25	<0.02
		0.25	<0.02
30	2	--	--
30	3	--	--
30	4	--	--
30	5	0.23	<0.02
30	6	0.25***	<0.02***
30	9	0.23***	<0.02***
30	12	0.23	<0.02
30	18	0.24	<0.02
30	24	0.24	<0.02
Expected Results:		0.25 ± 0.04	NMT 0.02

\*\*\* SOP QG162 (AKA Q1032) was not followed; NLT one injection per test vial (two test vials per lot) was not performed.

FIGURE 14(B)

STABILITY OF BETAFERON / BETAFERON FINAL CONTAINER PRODUCT  
 RESULTS FOR LOT MEDPN008 (MANNITOL FORMULATION)

Storage Temp. (°C)	Months in Storage	Appearance				Residual Moisture (% by weight)	pH Upon Reconstitution	Potency CPE Blot assay (IU/mg x 10 <sup>7</sup> )	Container Closure Integrity Dye Leak Test	Sterility
		Flag (cask)	Upon Reconstitution	Upon Reconst. Clarity	Upon Reconst. Color					
	0	white	clear, colorless	--	--	0.3	7.3	2.9	--	Pass
4	2	--	--	--	--	0.5	--	--	--	--
4	3	white	clear, colorless	--	--	0.5	7.4	2.7	--	--
4	4	--	--	--	--	0.5	--	--	--	--
4	5	--	--	--	--	--	--	--	--	--
4	6	white	clear, colorless	--	--	0.5	7.5	3.3	--	--
4	9	white	clear, colorless	--	--	0.6	7.6	3.4	--	--
4	12	white	clear, colorless	--	--	0.6	7.6	3.2	--	--
4	18	white	clear, colorless	<II	colorless	0.6	7.5	2.8	--	--
4	24	white	clear, slightly yellow	<II	>BY <sub>1</sub>	0.6	7.6	3.3	Pass	Pass
30	2	--	--	--	--	0.7	--	--	--	--
30	3	white	clear, colorless	<II	--	0.7	7.5	3.0	--	--
30	4	--	--	--	--	0.6	--	--	--	--
30	5	--	--	--	--	--	--	--	--	--
30	6	white	clear, slightly yellow	<II	BY <sub>6</sub>	0.7	7.5	3.4	--	--
30	9	white	clear, colorless	II	<BY <sub>6</sub>	1.0	7.6	3.4	--	--
30	12	white	clear, colorless	--	--	0.9	7.6	3.2	--	--
30	18	white	clear, colorless	III	colorless	1.0	7.6	2.9	--	--
30	24	white	clear, slightly yellow	<II	>BY <sub>2</sub>	1.1	7.6	3.2	Pass	Pass
European Specifications:		White	Clear, colorless to light yellow	NMT Ref III	Colorless to slightly yellow BY <sub>5</sub>	NMT 3%	7.3-7.8	2.2 to 4.5 x 10 <sup>7</sup>	Pass	Pass

FIGURE 15(A)



**STABILITY OF BETASERON / BETAFERON FINAL CONTAINER PRODUCT  
RESULTS FOR LOT MBDPN008 (MANNITOL FORMULATION)**

Storage Temp. (°C)	Months in Storage	RP-HPLC Analysis	
		Interferon beta-1b (Peak B + Peak B1)	Peak B1 (glucosylated) (mg/ml)
	0	-	-
4	2	-	-
4	3	-	-
4	4	-	-
4	5	-	-
4	6	0.23	<0.02
4	9	0.24***	<0.02***
4	12	0.23***	<0.02***
4	18	0.23	<0.02
4	24	0.24	<0.02
4		0.25	<0.02
30	2	-	-
30	3	-	-
30	4	-	-
30	5	0.23	<0.02
30	6	0.24***	<0.02***
30	9	0.22***	<0.02***
30	12	0.22	<0.02
30	18	0.23	<0.02
30	24	0.23	<0.02
Expected Results:		0.25 ± 0.04	NMT 0.02

\*\*\* SOP QG162 (AKA Q1052) was not followed: NLT one injection per test vial (two test vials per lot) was not performed  
Note: A correction was made to the 18 month data point for RP-HPLC.

**FIGURE 15(B)**

STABILITY OF BETASERON / BETAFERON FINAL CONTAINER PRODUCT  
RESULTS FOR LOT MBDEN009 (MANNITOL FORMULATION)

Storage Temp. (°C)	Months in Storage	Appearance				Residual Moisture (% by weight)	pH Upon Reconstitution	Potency CPE Blebsay (IU/mg x 10 <sup>7</sup> )	Container Closure Integrity Dye Leak Test
		Plug (c-ke)	Upon Reconstitution	Upon Recon. Clarity	Upon Recon. Color				
0		white	clear, colorless	-	-	0.4	7.3	3.0	-
4	2	N/A	N/A	-	-	0.5	-	-	-
4	3	white	clear, colorless	-	-	0.5	7.3	2.9	-
4	4	N/A	N/A	-	-	0.5	-	-	-
4	5	N/A	N/A	-	-	-	-	-	-
4	6	white	clear, slightly yellow	-	-	0.4	7.3	2.3	-
4	9	white	clear, colorless	-	-	0.6	7.4	3.0	-
4	12	white	clear, colorless	-	-	0.5	7.4	3.1	-
4	18	white	clear, colorless	<III	colorless	0.8	7.5	2.9	-
4	24	white	clear, slightly yellow	<II	>BY <sub>1</sub>	0.6	7.4	3.2	Pass
30	2	N/A	N/A	-	-	0.6	-	-	-
30	3	white	clear, colorless	-	-	0.6	7.3	3.2	-
30	4	N/A	N/A	-	-	0.5	-	-	-
30	5	N/A	N/A	-	-	-	-	-	-
30	6	white	clear, slightly yellow	-	-	0.5	7.4	2.4	-
30	9	white	clear, colorless	-	-	0.7	7.5	3.2	-
30	12	white	clear, colorless	-	-	0.7	7.4	3.1	-
30	18	white	clear, colorless	III	colorless	1.0	7.4	3.1	-
30	24	white	clear, slightly yellow	<III	>BY <sub>2</sub>	1.0	7.4	3.3	Pass
European Specification		White	Clear, colorless to light yellow	NMT Ref III	Colorless to slightly yellow NMT BY <sub>2</sub>	NMT 3%	7.1-7.8	2.2 to 4.5 x 10 <sup>7</sup>	Pass

FIGURE 16(A)

STABILITY OF BETAFERON / BETAFERON FINAL CONTAINER PRODUCT  
RESULTS FOR LOT MEDPN009 (MANNITOL FORMULATION)

Storage Temp. (°C)	Months in Storage	RP-HPLC Analysis	
		Interferon beta-1b (Peak B + Peak B1) (mg/ml)	Peak B1 (%unacylated) (mg/ml)
	0	--	-
4	2	-	-
4	3	-	-
4	4	-	-
4	5	-	-
4	6	0.24	<0.02
4	9	0.25***	<0.02***
4	12	0.24***	<0.02***
4	18	0.23	<0.02
4	24	0.25	<0.02
30	2	--	-
30	3	-	-
30	4	-	-
30	5	0.22	<0.02
30	6	0.25***	<0.02***
30	9	0.24***	<0.02***
30	12	0.23	<0.02
30	18	0.24	<0.02
30	24	0.24	<0.02
Expected Results		0.25 ± 0.04	NMT 0.02

\*\*\* SOP QG162 (AKA Q1052) was not followed; NLT one injection per test vial (two test vials per lot) was not performed.  
Note: A correction was made to the 18 month data point for RP-HPLC.

FIGURE 16(B)

## REDUCING ACTIVITY IN MANNITOL SAMPLES

Sample No.	Sample	Reducing Activity Content (ppm)	Mean Value (ppm)
1	Sample # 1 Unpurified	53.7	44.1
2	Sample # 2 Unpurified	44.1	
3	Sample # 3 Unpurified	34.4	
4	Sample # 1 Methanol Treated	19.3	18.5
5	Sample # 2 Methanol Treated	19.2	
6	Sample # 3 Methanol Treated	17.0	
7	Highly Purified Mannitol # 1	10.5	10.2
8	Highly Purified Mannitol # 2	11.2	
9	Highly Purified Mannitol # 3	8.9	

FIGURE 17